

# Investigating green: Creating surveys to answer questions

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**B**eing green means different things to different people. Some suggest that being green means saving energy, not wasting paper towels, going solar, harnessing wind, using less fertilizer, or buying products that are organically grown. Given that being green can mean a lot of things, what does “being green” or “going green” mean to both you and your students? To find out, we need to make informed decisions by collecting data. When we gather data, it has to be done in a systematic manner in order to make valid interpretations. Data can be obtained in a variety of ways: by observing, experimenting, interviewing, reading, or surveying. Of all the methods for collecting data, the survey method is perhaps the most ubiquitous research tool.

What are surveys and why are they used? Surveys are instruments used to either test hypotheses or to learn about individuals’ ideas, perceptions, and attitudes about a variety of topics. Surveys can also be used to collect demographic information and descriptive data about behaviors. Researchers who administer surveys get information by asking questions of the participants. This is why surveys are also known as questionnaires. One way to categorize surveys is by the number of times respondents are asked to participate in a project. Cross-sectional surveys are used to collect data in which respondents reply once, while longitudinal surveys are used to collect data in which the same respondents reply more than once over a period of time. One of the most common cross-sectional surveys is the Nielsen ratings for television viewing. This system simply identifies who is watching what television programs at any given time. A widely known study that incorporates longitudinal data is the Nurses’ Health Study. This study has used survey data to track and identify lifestyle behaviors in order to establish patterns related to women’s health issues. The original study began in 1976, and over time, expanded to an estimated 238,000 women enrolled. Since its inception, it has had a 90% ongoing participation rate (Nurses’ Health Study 2008). The purpose of this article is to become familiar with some of the basic steps involved in designing a survey to identify

people’s attitudes, feelings, beliefs, or knowledge about environmental issues and being green.

## Testing the limits of agreement

The first step, as in any research project, is to find a problem. Next, the investigator needs to define a purpose and list the subsequent steps needed to complete the survey research project (this is the most important step). The initial question to ask is: Why is the survey being conducted? The answer should be as specific as possible.

It is at this initial stage that students start to realize that language is abstract. Even words that students once thought of as having very precise definitions can become difficult to delimit. To demonstrate this problem, ask students to think of the color purple. Then, hold up a purple color sample that can be obtained from any paint store. Ask students if they agree that the color sample you are holding up in front of the class is purple. Next, use a variety of shades of purple—from light lavender to a deep eggplant (see Figure 1). It is interesting to determine at what point students agree that a color sample is still purple. To answer this question, it is important for teachers to emphasize operationally defined terms, which are expressions that nearly everyone will define the same way. For example, we may differ in agreement that someone “understands” how to add numbers, but we would have greater agreement if told that this same individual “is able to add two whole numbers whose sum is less than 10.”

This is also a good place to introduce various ways in which individuals can reach agreement. We can make a decision by consensus, which involves agreement by all of the participants, or by majority, which is determined when 51% or more of the participants are in agreement.

## Who will participate in your study?

As students begin to make decisions about the project, they may learn that their resources are not limitless. Therefore, it will be necessary to make decisions about time, costs, and students (personnel) available to write the survey, print or put the survey online, analyze the

**FIGURE 1**

**Color sample**



data, and disseminate the results. Students may wish to define a sample from the population. A sample should be representative of the participants in a total population. A good sample should be randomly selected, because this provides a better opportunity for a representative sample from the population than other forms of selection. If the middle school population includes students in grades 5, 6, 7, and 8, then there should be a proportionate number of members of each grade level in the sample. In addition, students need to be aware of a balance between males and females, and any other variables that may create subgroups within an overall population. The larger the sample size, the more likely it is to be representative of the overall population of a class or school. This will increase the survey's validity and make the results more generalizable to the population from which the sample was selected. The acceptable sample sizes vary depending on the type of research being conducted. Descriptive research generally requires a minimum of 10% of the population to be used in the sample. Questions that will involve the correlation of data will require a minimum of 30 students per group. Experimental studies, which also require a minimum of 30 students per group, have the strictest controls, including random selection and random assignment of participants in the study (Gay and Airasian 2000). As soon as the number of students who will participate in the project is decided, the best way to avoid sampling bias (i.e., reduce error) is to randomly select the students who will participate in the survey from the overall population.

Sampling procedures for a survey can be very flexible and the answers that students are seeking can be open ended. This all depends on the questions being asked, the type of research being conducted, and the population under study. Students should realize that samples and populations change, depending on the questions under investigation. In addition, students should consider how large a sample size should be. For example, if a class is considered as a population, then selecting individual class members may make up a sample. If a grade level is considered as a population, then selecting members from each of the classes in the grade level may make up a sample. If a school is to represent a population, then selecting members from each of the grade levels of the school may make up a sample. If a district is

**FIGURE 2**

**Common formats used in surveys**

## Demographic data

Students who have taken standardized tests are somewhat used to providing test makers with demographic data. Researchers asking demographic data questions may ask respondents to put a checkmark (✓) next to an item, or to write a response next to a specific question. Here are some examples:

1. Gender: Male \_\_\_\_\_ Female \_\_\_\_\_
2. Grade level: 5 \_\_\_\_\_ 6 \_\_\_\_\_ 7 \_\_\_\_\_ 8 \_\_\_\_\_ 9 \_\_\_\_\_

## Checklist model

3. Below is a list of environmental issues. Put a check after each item that has been sufficiently discussed in science class this year.

- Water pollution \_\_\_\_\_
- Global warming \_\_\_\_\_
- Sustainable agricultural practices \_\_\_\_\_
- Overfishing of the oceans \_\_\_\_\_

## Preference model

4. Below is a list of environmental concerns. Number the items from 1 to 3 with "1" being the most important concern and "3" being of least concern.

- \_\_\_\_\_ Water pollution
- \_\_\_\_\_ Overuse of pesticides
- \_\_\_\_\_ Rising ocean levels

## Likert-scale model

Below are a number of statements about global warming. Read each statement and decide to what extent you would agree or disagree with that statement. Circle (SA) if you strongly agree, (A) if you agree, (U) if you are undecided, (D) if you disagree, or (SD) if you strongly disagree.

5. Global warming is a natural phenomenon.  
(SA) (A) (U) (D) (SD)
6. Global warming is a product of human activity.  
(SA) (A) (U) (D) (SD)
7. Global warming has a negative impact on the planet.  
(SA) (A) (U) (D) (SD)

## Free- or open-response model

8. Write a brief explanation as to why you feel global warming is or is not an important environmental concern.

to represent a population, then selecting members from each of the schools in the district may make up a sample. As you can see, a population can get very large, depending on what students are attempting to study.

Many surveys use some type of probability sampling to ensure representation of all groups within the population. Others use a sample of convenience. Simply put, a sample of convenience would include any respondents who are available to participate in the survey. However, in many science endeavors, scientists prefer random sampling. This method is used to select individuals from the population completely by chance to eliminate as much bias as possible. *Bias* is defined as a distortion of the data. The data can be affected by research design, researcher treatment of the data, the respondents' willingness or motivation as participants, analysis selected, or method of dissemination. If not addressed, each of these factors contributes to bias or adds to error. The goal in conducting research is to answer a question with as much accuracy as possible—in other words, reducing error to a minimum.

**FIGURE 3**

## Possible green topics to investigate

- Wind, solar, and other alternative energy resources
- Recycling
- What does it mean to live green?
- Green construction: building and remodeling
- Safe paints and wall coverings
- Identifying our carbon footprint
- Point source vs. nonpoint source pollution
- Destruction of wetlands
- How “green” are lawns?
- Energy-saving appliances
- Overfishing
- Proper disposal or recycling of used electronic devices
- Green industrial/manufacturing chemistry
- Green agricultural chemistry (insecticides/pesticides/fertilizers)
- Green chemistry in the home and laboratory (microchemistry)
- Rainwater harvesting/permeable pavement/porous asphalt
- Bottled water ban/debate
- Growing produce close to home
- What happens to old tires?
- Packaging (paper vs. plastic)
- Batteries (impact, alternatives, disposal)
- Burning of fossil fuels (oil, natural gas, coal)
- Clean coal technology

## Twenty considerations for constructing a sample survey

1. Find a problem to investigate. For example: How can we as individuals reduce our overall water consumption? The survey can be designed to ask a number of ways in which individuals use water in their daily lives. This should include water consumed at home, water consumed during recreational activities, and water consumed at school.
2. Read about the topic in order to identify important questions to be asked.
3. Develop a hypothesis if it will add clarity to the investigation. For example: Eighth-grade middle school students consume more water in the course of one day than sixth-grade middle school students.
4. Write a short description to inform the participants of the purpose of the survey.
5. Make participation voluntary and anonymous. This will attract more individuals to participate in the survey.
6. Decide on the best format for questions and for respondents' answers (see Figure 2).
7. Practice economy of expression. Questions should be to the point and not too wordy. Ask only what needs to be asked. For example:
  - Does your shower contain a water-saving device? (yes / no / unsure)
  - How many times a day do you take a shower? (none / 1 / 2 / more than 2)
  - If you answered “1” or more, how many minutes is your shower? (1 minute / 3 minutes / 5 minutes / more than 5 minutes)
8. Use concrete language or commonly used words. Short words and sentences are easier to comprehend than longer ones.
9. Avoid compound questions—write questions that can be answered by a single response (see Activity Worksheet 2).
10. Keep a standard format for questions and responses, for example, “1” to “5” or “low” to “high” (see Likert-scale-model information in Figure 2).
11. Provide an example of how to answer the question. This should help to ensure accuracy of responses.
12. Leave adequate space if respondents are to write their answers to questions. If the survey is given as an interview, provide ample time between each question for individuals to respond.
13. Keep questions and responses together.
14. Proofread your survey.
15. Get written permission to administer the survey from the appropriate authority. This individual might be a principal or a superintendent.

## Activity Worksheet: Rewriting survey questions for clarity

**Examine questions 1 to 4.** For each question, determine whether it represents a single idea that can be answered by the choices given and that the language used in the question can be easily understood by the reader.

- 1. Mercury is a highly toxic, inorganic substance that is found in the environment and occurs both naturally and as a direct result of human activity.**  
Agree\_\_\_\_\_ Disagree\_\_\_\_\_

**Answer:** Question 1 is a compound question that asks respondents to answer two separate questions. If the question is answered in its current format, the researcher will not be sure if the respondent agrees or disagrees that mercury is found naturally in the environment or as a result of human activity. In addition, the word “inorganic” might need to be defined for a large majority of the population and can probably be omitted because it does not change the overall meaning of the question. Also, the term “human activity” requires further explanation. Therefore, question 1 should be separated into two questions:

- (a) Mercury is a highly toxic substance found naturally in the environment. Agree\_\_\_\_\_ or disagree\_\_\_\_\_  
(b) Mercury is a highly toxic substance that is found in the environment as a direct result of industrial manufacturing. Agree\_\_\_\_\_ Disagree\_\_\_\_\_

The questions can be further refined in the following ways:

- (a) Mercury is a toxic substance.  
Agree\_\_\_\_\_ Disagree\_\_\_\_\_  
(b) Mercury is found naturally in the environment.  
Agree\_\_\_\_\_ Disagree\_\_\_\_\_  
(c) Mercury is introduced to the environment by some industrial manufacturing. Agree\_\_\_\_\_ Disagree\_\_\_\_\_

- 2. Replacing incandescent bulbs with fluorescent bulbs that have similar lamp lumen outputs saves energy.** Agree\_\_\_\_\_ Disagree\_\_\_\_\_

**Answer:** As long as respondents understand the meanings of “incandescence,” “fluorescence,” and “lamp lumen outputs,” sample question 2 is written correctly because it represents a single question to consider—namely, that changing one type of light source to another will save energy.

- 3. The contaminants mercury and dioxin can be cooked out of seafood.**  
Agree\_\_\_\_\_ Disagree\_\_\_\_\_

**Answer:** Question 3 is a compound question that asks respondents to answer two separate questions. Like ques-

tion 1, question 3 should read as two separate questions to identify if respondents have different ideas about each of the contaminants:

- (a) The contaminant mercury can be cooked out of seafood. Agree\_\_\_\_\_ Disagree\_\_\_\_\_  
(b) The contaminant dioxin can be cooked out of seafood. Agree\_\_\_\_\_ Disagree\_\_\_\_\_

- 4. The sealing of windows and doors or replacing windows and doors are cost-effective ways to go green.**  
Agree\_\_\_\_\_ Disagree\_\_\_\_\_

**Answer:** Once again, in question 4, the survey author is asking the respondent to answer two separate questions. The respondent may agree that sealing leaking windows and doors is a cost-effective method to save energy, but may not agree that buying new windows is the most green solution. In addition, some may argue that the sealing of windows is efficient, but the sealing of doors is not. A similar argument could be made for replacing windows as an efficient, energy-saving action, but not replacing a door because it would not provide the same benefit. The test writer should be sure that respondents are not forced to make a selection that does not fully represent their opinion. If the respondents are forced to make a selection that does not fully represent their opinion, the accuracy of the data is questionable. Also, notice the slight difference in question 4a below. The focus of the revised question is on sealing the cracks, and not specifically on windows and doors.

- (a) The sealing of cracks around windows and doors is a cost-effective, green option.  
Agree\_\_\_\_\_ Disagree\_\_\_\_\_  
(b) Replacing windows and doors is a cost-effective, green option. Agree\_\_\_\_\_ Disagree\_\_\_\_\_

Question 4b can be further refined in the following two ways:

1. Replacing windows is a cost-effective, green option.  
Agree\_\_\_\_\_ Disagree\_\_\_\_\_  
2. Replacing doors is a cost-effective, green option.  
Agree\_\_\_\_\_ Disagree\_\_\_\_\_

Writing the question in this format allows the respondent to further discriminate between windows and doors.

Now that you have had some practice in analyzing possible questions for surveys, think of a green topic that you might like to investigate. See Figure 3 for a suggested list of topics. Try writing some survey questions about your topic and give them to a friend to answer. See if your friend can follow your written instructions and answer your questions with as little direction from you as possible.



16. Test the survey on a small sample of students to identify problems early on.
17. Correct any problems, if necessary, and prepare the remaining surveys.
18. Distribute, administer, and collect surveys for analysis.
19. Conduct analysis and review findings in relationship to the original question.
20. Provide respondents with the results of the survey and disseminate the results to all interested parties.

When reporting results, students should describe the sample population, including the number of students who have participated at each grade level and the gender or any other descriptive information that is relevant to answering the question under investigation. Surveys should try to handle one topic, question, or problem at a time in order to gather specific information. A shorter survey that is on topic will avoid creating fatigue and will increase the likelihood of more-accurate responses. Review each question asked on the survey to determine

that the information being gathered helps to provide information to the initial investigation. ■

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